Using a Geographic Information System to Understand Child Pedestrian Injury

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ABSTRACT

Data from police accident reports involving pedestrians less than 20 years of age in Hartford, Conn, during 1988 through 1990 were abstracted and entered into a geographic information system. Two high-frequency collision areas were identified and compared. There were 374 child pedestrians involved in collisions (a rate of 28 per 10 000). Two high-occurrence areas accounted for 30% of collisions. Collisions in one of these areas were more likely to involve younger children (8.1 vs 10.2 years of age) and to occur in the late afternoon, and occurred closer to the child's residence, than collisions in the other area. The geographic information system is a useful tool in the study of child pedestrian collisions. (*Am J Public Health.* 1994;84:1158–1161)

Introduction

Mapping disease events is a traditional approach to public health research.[1-7] However, point maps are an inefficient way of providing information for the development, implementation, and evaluation of public health programs.[8]

Geographic information systems allow management, analysis, and reporting of thematic data (demographics, health status indicators) within their geographic context (locations, boundaries).[9] Because many injuries have a strong geographic component, they are well suited to geographic information system analysis.[10-18] The purpose of this study was to demonstrate the usefulness of a geographic information system in examining child pedestrian collisions in Hartford, Conn.

Methods

All motor vehicle collisions reported to the Hartford police department between January 1, 1988, and December 31, 1990, involving pedestrians under 20 years of age were examined. Copies of police accident reports were obtained from the Connecticut Department of Transportation, and the following information was abstracted: date and time of collision, collision location, environmental conditions, vehicle type, pedestrian/vehicle maneuvers, contributing factors, pedestrian/driver age and sex, pedestrian place of residence, and injury severity.

A commercial geographic information system, TransCad,[19] was used to code the site of collision and pedestrian residence by address-matching these sites with the 1990 US Census TIGER/Line files for Hartford County.[20] Distances from collision sites to pedestrian residences were computed. The geographic information system produced point maps of collision and pedestrian residential locations.

Two areas of high collision density were identified for analysis. Descriptive, univariate statistics for collision, driver, and pedestrian characteristics were calculated. Because the data include the universe of all collisions during 1988 through 1990, inferential statistical procedures were not performed. Population data used to calculate rates were obtained from the 1990 census.[21]

Results

Between January 1, 1988, and December 31, 1990, there were 358 child pedestrian collisions in Hartford. These collisions occurred uniformly throughout the study period and involved 382 vehicles and 374 child pedestrians, resulting in an annual age-specific collision rate of 28 per 10 000 persons.

A point map of child pedestrian collision locations reveals that the collisions were distributed in a nonuniform manner with several high-frequency areas (Figure 1). Figure 2 selectively illustrates two high-frequency collision areas that accounted for 30% of all collisions. The Albany Avenue area is a 1.4 × 0.8 km (0.9 × 0.5 mile) section along Albany Avenue, a major commuting artery carrying an average traffic volume of 10 000 to 25 000 motor vehicles per day. The Park Street area is a 1.3 × 0.5 km (0.8 × 0.3 mile) section of a collector road carrying an average traffic volume of 3000 to 10 000 vehicles per day.[22] Both neighborhoods are densely populated with two- to three-story buildings of mixed residential/commercial land use.

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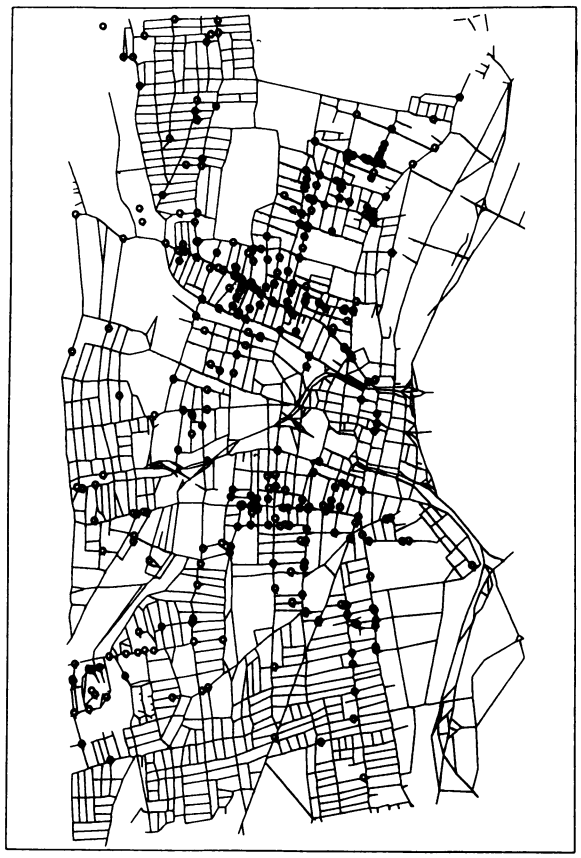

FIGURE 1—Child pedestrian–motor vehicle collision sites: Hartford, Conn, 1988 through 1990.

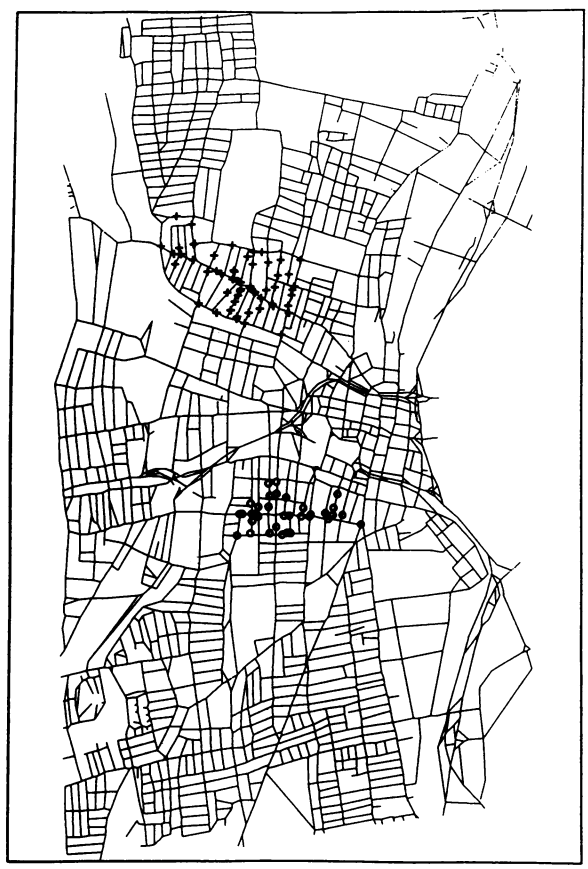

FIGURE 2—Albany Avenue (+) and Park Street (open circles) area collision sites, 1988 through 1990.

Sixty-nine collisions occurred in the Albany Avenue area, and 38 collisions occurred within the Park Street area. Figure 3 illustrates the location of the residences of children involved in pedestrian collisions in the two areas.

The characteristics of the two collision areas are compared in Table 1. In comparison with collisions in the Albany Avenue area, a greater proportion of those in the Park Street area occurred in the hours after school dismissal (61% vs 46%), on weekends (29% vs 20%), and during the summer (32% vs 17%). Children struck in the Albany Avenue area were older (mean ± SD = 10.2 ± 5 vs 8.1 ± 5 years) and more likely to be seriously or fatally injured (32% vs 13%) than those struck in the Park Street area. Driver error was more often a factor in the collisions occurring in the Albany Avenue area (29% vs 18%). Collisions in the Albany Avenue area also occurred at a greater (mean ± SD) distance from the child's place of residence (0.62 ± 0.8 vs 0.43 ± 0.8 km [0.39 ± 0.5 vs 0.27 ± 0.5 miles]). Collisions in the Park Street area more often occurred at intersections without a traffic signal (30% vs 14%). Collisions in both areas tended to occur on dry pavement and to involve male drivers in passenger cars. In general, characteristics of collisions in the Albany Avenue area were more similar to those elsewhere in the city.

Discussion

Pedestrian collisions are a leading cause of injury death and hospitalization among school-aged children.[12-14,23] Research shows that these collisions are not uniformly distributed within a city.[12-14] This study used a geographic information system to illustrate differences between two collision sites in Hartford, Conn.

Data were taken from police accident reports, which are known to underestimate the occurrence of nonroadway pedestrian collisions.[24,25] Nevertheless, police data include most serious traffic injuries to children and contain other valuable information concerning the collision event.[12-14,24-26]

This study found several differences between the two collision sites in Hartford. Of particular interest was the differing proximity of child residences to pedestrian collision sites. This type of information, which would not be easily accessible without geographic information system technology, has important implications for understanding and preventing child pedestrian collisions. A site-specific intervention suitable for the Albany Avenue area might include education aimed at school-aged children; environmental modifications designed to decrease traffic flow, improve intersection crossing times, and increase child pedestrian visibility; and improved police enforcement of vehicle speed laws and adherence to traffic signs. In the Park Street area, educational efforts directed at parents of preschoolers and school-

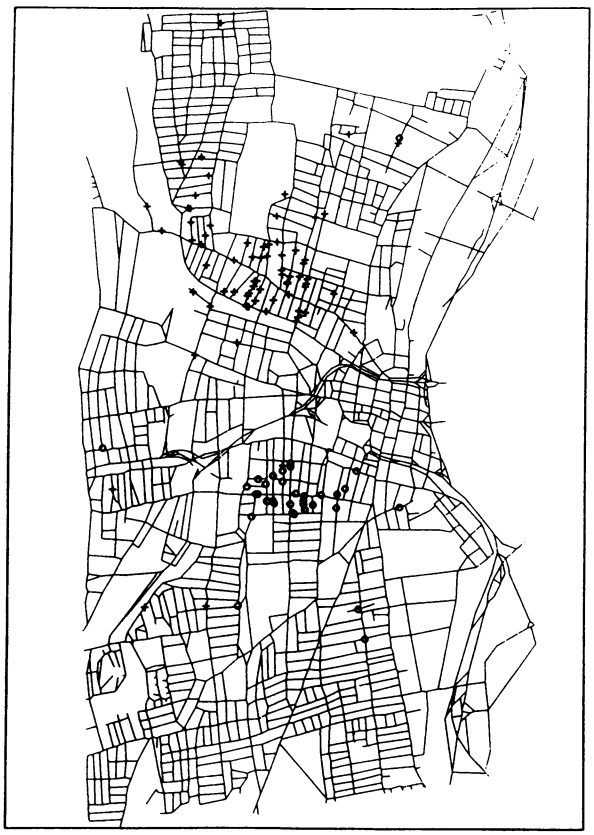

FIGURE 3—Residential locations of children involved in pedestrian collisions in the Albany Avenue (+) and Park Street (open circles) areas, 1988 through 1990.

TABLE 1—Attributes of Collisions by Site: Hartford, Conn, 1988 through 1990

	Albany Ave (n = 69)	Park St (n = 38)	All Other (n = 251)
Environment			
Season, %			
Summer	17	32	30
Fall	33	26	23
Winter	13	16	16
Spring	36	27	32
Time of day, %			
6 AM–10 AM	12	0	9
10 AM–2 PM	20	18	15
2 PM–6 PM	46	61	48
6 PM–10 PM	20	16	27
Weekend day (Saturday, Sunday), %	20	29	30
Slippery road conditions (rain, snow, ice, oil), %	17	13	17
Driver			
Mean age, y (SD)	32.7 (11)	35 (14)	35.5 (15)
Male, %	74	79	73
Passenger car, %	83	87	83
Driver contributing factors (inattentiveness, speed, traffic violation), %	29	18	29
Nonturning vehicle manuever, %	71	84	78
Pedestrian			
Mean age, y (SD)	10.2 (5)	8.1 (5)	10.0 (5)
Median age, y	9	7	9
Age distribution, y, %			
0–4	9	29	13
5–9	49	40	40
10–14	17	18	21
15–19	25	13	26
Male, %	58	58	67
Pedestrian contributing factors, %			
Crossing between intersections	47	40	46
Crossing at intersection			
With no traffic signal	14	30	13
Against traffic signal	5	4	5
Walking/playing in roadway	3	5	5
Crossing behind other vehicle	19	16	19
Distance from home to collision site, km, mean (SD)	0.62 (0.8)	0.39 (0.8)	0.82 (1.1)
Injury severity, %			
Death	3	0	1
Disability	29	13	29
Visible, not disabling	33	53	32
Probable, not visible	33	32	35
No injury	2	2	3

aged children, increased use of warning signs and crossing signals, and the development of off-street playground areas might be effective prevention strategies.

We are currently investigating other geographic features that may play an important role in child pedestrian collision etiology, such as schools, parks, playgrounds, and convenience stores. In conclusion, the ability of a geographic information system to illustrate spatial relationships between pedestrian collision sites and other city landmarks advances the study of pedestrian injuries. □

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The Compliance of Licensed US Child Care Centers with National Health and Safety Performance Standards

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ABSTRACT

The American Public Health Association and the American Academy of Pediatrics recently published health and safety guidelines for child care centers. A survey was conducted to determine the extent to which practices in US child care centers are reflective of these guidelines. Compliance with 16 guidelines ranged from 19.5% to 98.6%, varied considerably by state, and was not consistently associated with selected center characteristics. Prevention efforts should focus on practices for which compliance is low and on those that have the greatest disease- and injury-reducing potential. (*Am J Public Health.* 1994;84:1161–1164)

Introduction

In 1992, the American Public Health Association and the American Academy of Pediatrics published performance guidelines for the control of infectious diseases and injuries in US child care centers.[1] Adoption of these guidelines by providers will depend, in part, on whether compliance requires substantial or costly changes in child care practices, policies, or facilities. In November and December 1990, before the guidelines were published, we conducted a survey to determine the extent to which policies and practices in US child care centers were consistent with these guidelines.

Methods

A total of 2003 child care center directors were interviewed by telephone about their policies and practices for control and prevention of infectious diseases and injuries. This nationally representative sample was selected from lists of licensed child care centers in all 50 states, 14 local jurisdictions, and the District of Columbia. A minimum of 20 centers was randomly selected from each jurisdiction; the remainder of the sample was proportionately allocated according to the number of centers in each jurisdiction. Responses were weighted to obtain national estimates, and SUDAAN software[2] was used to compute 95% confidence inter-

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